

What is claimed is:

1. A method of manufacturing a semiconductor device, in which a thermal treatment, including a temperature rising process, a main treatment process in which a predetermined final temperature is maintained for a predetermined time, and a temperature falling process, is performed to a semiconductor wafer by using a single-wafer apparatus, the method comprising the steps of:

making open-loop control in said temperature rising process in which the temperature of said semiconductor wafer is relatively low;

making closed-loop control in said temperature rising process in which the temperature of said semiconductor wafer is relatively high and in said main treatment process;

rotating said semiconductor wafer at a relatively low revolution speed in a process for making said open-loop control; and

rotating said semiconductor wafer at a relatively high revolution speed in a process for making said closed-loop control.

2. The method of manufacturing a semiconductor device according to claim 1,

wherein said semiconductor wafer is rotated at a constant first revolution speed in the process for making said open-loop control, and said semiconductor wafer is rotated at a constant second revolution speed different

from said first revolution speed in the process for making said closed-loop control.

3. The method of manufacturing a semiconductor device according to claim 2,

wherein when said semiconductor wafer has a diameter of 200 mm or smaller, the revolution speed of said semiconductor wafer is 100 rpm or lower in the process for making said open-loop control, and is in a range of 150 to 250 rpm in the process for making said closed-loop control.

4. The method of manufacturing a semiconductor device according to claim 2,

wherein when said semiconductor wafer has a diameter of 300 mm or larger, the revolution speed of said semiconductor wafer is 100 rpm or lower in the process for making said open-loop control, and is in a range of 200 to 300 rpm in the process for making said closed-loop control.

5. The method of manufacturing a semiconductor device according to claim 1,

wherein said semiconductor wafer is rotated at a constant revolution speed in the process for making said open-loop control, and is rotated at a gradually increased revolution speed in the process for making said closed-loop control.

6. The method of manufacturing a semiconductor device according to claim 1,

wherein said semiconductor wafer is rotated at a gradually increased revolution speed in the process for

making said open-loop control, and is rotated at a constant revolution speed in the process for making said closed-loop control.

7. The method of manufacturing a semiconductor device according to claim 1,

wherein said semiconductor wafer is rotated at a gradually increased revolution speed in each of the processes for making said open-loop control and said closed-loop control.

8. A method of manufacturing a semiconductor device, in which a thermal treatment, including a treatment rising process, a main treatment process in which a predetermined final temperature is maintained for a predetermined time, and a temperature falling process, is performed to a semiconductor wafer by using a single-wafer apparatus, the method comprising the steps of:

rotating said semiconductor wafer at a relatively low revolution speed in said temperature rising process in which the temperature of said semiconductor wafer is 500°C or lower; and

rotating said semiconductor wafer at a relatively high revolution speed in said temperature rising process in which the temperature of said semiconductor wafer is higher than 500°C and in said main treatment process.

9. The method of manufacturing a semiconductor device according to claim 8,

wherein said semiconductor wafer is rotated at a

constant first revolution speed in said treatment rising process in which the temperature of said semiconductor wafer is 500°C or lower, and is rotated at a constant second revolution speed different from said first revolution speed in said temperature rising process in which the temperature of said semiconductor wafer is higher than 500°C and in said main treatment process.

10. The method of manufacturing a semiconductor device according to claim 9,

wherein when said semiconductor wafer has a diameter of 200 mm or smaller, the revolution speed of said semiconductor wafer is 100 rpm or lower in said temperature rising process in which the temperature of said semiconductor wafer is 500°C or lower, and is within a range of 150 to 250 rpm in said temperature rising process in which the temperature of said semiconductor wafer is higher than 500°C and in said main treatment process.

11. The method of manufacturing a semiconductor device according to claim 9,

wherein when said semiconductor wafer has a diameter of 300 mm or larger, the revolution speed of said semiconductor wafer is 100 rpm or lower in said treatment rising process in which the temperature of said semiconductor wafer is 500°C or lower, and is within a range of 200 to 300 rpm in said temperature rising process in which the temperature of said semiconductor wafer is higher than 500°C and in said main treatment process.

12. The method of manufacturing a semiconductor device according to claim 8,

wherein said semiconductor wafer is rotated at a constant revolution speed in said temperature rising process in which the temperature of said semiconductor wafer is 500°C or lower, and is rotated at a gradually increased revolution speed in said temperature rising process in which the temperature of said semiconductor wafer is higher than 500°C and in said main treatment process.

13. The method of manufacturing a semiconductor device according to claim 12,

wherein when said semiconductor wafer has a diameter of 300 mm or larger, said semiconductor wafer is rotated at a constant revolution speed within a range of 100 rpm or lower in said treatment rising process in which the temperature of said semiconductor wafer is 500°C or lower, and is rotated at a gradually increased revolution speed from 100 rpm or lower to a range of 200-300 rpm in said temperature rising process in which the temperature of said semiconductor wafer is higher than 500°C and in said main treatment process.

14. The method of manufacturing a semiconductor device according to claim 8,

wherein said semiconductor wafer is rotated at a gradually increased revolution speed in said temperature rising process in which the temperature of said

semiconductor wafer is 500°C or lower, and is rotated at a constant revolution speed in said temperature rising process in which the temperature of said semiconductor wafer is higher than 500°C and in said main treatment process.

15. The method of manufacturing a semiconductor device according to claim 14,

wherein when said semiconductor wafer has a diameter of 300 mm or larger, said semiconductor wafer is rotated at a generally increased revolution speed within a range of 100 rpm or lower in said treatment rising process in which the temperature of said semiconductor wafer is 500°C or lower, and is rotated at a constant revolution speed within a range of 200 to 300 rpm in said temperature rising process in which the temperature of said semiconductor wafer is higher than 500°C and in said main treatment process.

16. The method of manufacturing a semiconductor device according to claim 8,

wherein said semiconductor wafer is rotated at a gradually increased revolution speed in said temperature rising process in which the temperature of said semiconductor wafer is 500°C or lower, in said temperature rising process in which the temperature of said semiconductor wafer is higher than 500°C, and in said main treatment process.

17. The method of manufacturing a semiconductor device

according to claim 16,

wherein when said semiconductor wafer has a diameter of 300 mm or larger, said semiconductor wafer is rotated at a generally increased revolution speed within a range of 100 rpm or lower in said treatment rising process in which the temperature of said semiconductor wafer is 500°C or lower, and is rotated at a gradually increased revolution speed from 100 rpm or lower to a range of 200-300 rpm in said temperature rising process in which the temperature of said semiconductor wafer is higher than 500°C and in said main treatment process.